

**MEETING MINUTES**  
**CRC SCIENCE PANEL ON COASTAL HAZARDS**  
February 8, 2010

2728 Capital Blvd  
Raleigh, NC  
(notes compiled by Jeff Warren, DCM)

**Panel Members in Attendance:**

Steve Benton, DCM retired  
Bill Berkemeier, USACE ERDC  
Bill Cleary, UNCW  
Tom Jarrett, CP&E  
Margery Overton, NCSU (chair)  
Pete Peterson, UNCCH IMS  
Stan Riggs, ECU  
Spencer Rogers, NC Sea Grant  
Beth Sciaudone, NCSU adjunct / consultant  
Rob Young, WCU

**Panel Members not in Attendance:**

Dave Mallinson, ECU  
Tony Rodriguez, UNCCH IMS  
Greg Williams, USACE

**CRC members in attendance:**

Bob Emory, Chair  
Lee Wynns

**DENR/DCM Staff in attendance:**

Bonnie Bendell, DCM  
Jim Gregson, DCM  
Ken Richardson, DCM  
Guy Stefanski, DCM  
Steve Underwood, DCM  
Michele Walker, DCM  
Jeff Warren, DCM

**Moffatt & Nichol Staff in attendance:**

John Hedland  
Johnny Martin  
Jeff Sheldon  
Paul Tschirky  
Layton Bedsole (Dial Cordy – M&N subcontractor)  
Dawn York (Dial Cordy – M&N subcontractor)

## MEETING SUMMARY

Margery Overton opened the meeting at 10:12 and outlined the goals of the meeting, primarily to have a discussion over the draft report from Moffatt & Nichol (M&N) and develop consensus areas that M&N could use in generating its final draft report. Paul Tschirky from M&N stated he would address each of the four agenda items: 1) coastal and geological assessment, 2) environmental assessment, 3) economic assessment, 4) construction techniques, costs, locations. Tschirky gave a brief overview of the coastal and geological assessment including nourishment, dredging, and geologic setting data. The results summary included major issues such as shoreline change (shorelines on structure side of inlet were eroding prior to groin construction), nourishment and nearshore disposal volumes (beach along three miles from inlet associated with groin displays a reduction in eroded volume – except Amelia Island and one of the periods from the Oregon Inlet monitoring data), and dredging.

Tschirky opened it up for discussion and passed out three hardcopies. Young still wanted to discuss the process of how this document was going to be reviewed. Will there only be this hour today or can comments be provided after the fact to an arbitrator. Peterson also added a concern on who would assess if suggested changes had indeed been made in the final document. Overton noted that this was not an academic-style peer review process. Peterson was concerned about this. The use of the phrase “peer review” has serious meeting so maybe a different phrase is used. Young wanted to make sure he had a fair process so all of his questions could/would be answered. Overton agreed that we were physically limited by time at today’s meeting. Benton was concerned about the lack of time. Young wanted a process to submit written comments that could be evaluated and addressed. Overton noted that comments can go to M&N. Overton was wondering if Young wanted the full Panel to deliver a final set of comments and serve as the gatekeeper to M&N. Birkemeier noted that as long as the comments were recorded today than M&N could address them after the meeting. Overton wondered if there had to be a difference between individual comments and Panel comments (collective agreement). Peterson suggested that Jarrett and Young acted as the Panel’s gatekeepers and then check the subsequent M&N revision to ensure comments were addressed. Jarrett wondered what the expectations of the CRC committee that was assembled to address the terminal groin (TG) study. Were they looking for an endorsement of the M&N TG study by the Panel? Rogers wanted the term “peer reviewed” to be removed from the conversation. Overton didn’t feel that the Panel had been asked to endorse (or not endorse) the study or the report. However, the Panel has a method to collect their comments and pass them along. The Panel has also had clear input to the report/study (e.g., the five inlets chosen for the study). Peterson felt there was more consensus than not (during past meetings). Riggs felt that comments had been addressed by M&N but an expansion on those comments (for example, the consequences of sea level rise) were not addressed.

Riggs had a question to M&N about procedures in chapters two and three. How did you decided to look at the distances from the terminal groin along the shoreline? A three-mile window was used. Chapter two used three miles on either side for analysis but

chapter three focused on literature and existing data review (so the specific study areas were linked to existing data and analyses). Riggs was pointing out the area of the impact of the next five miles south of Oregon Inlet where the shoreline (beyond the first three immediately adjacent). Cleary asked how Riggs could relate that shoreline response to the terminal groin. Young wanted to go through the numbers at each site one at a time in the engineering chapter. Overton had a comment related to Oregon Inlet with the rates presented in chapter two (new analysis based on existing data) versus datasets presented in the following chapter which used different methods, data, and analyses. Peterson felt that even the environmental chapters didn't integrate the data well either.

Young wanted the nourishment numbers being used to “net out” the nourishment effect in a table. Overton wanted example calculations and reference the tabulated data so that people could recreate the calculations and results. Peterson would like to see the spatial extent of the nourishment data. Young wanted to know if there was more nourishment that went in prior to the structure versus after groin construction. Rogers would also like to have the tabulated data separated for each side of the inlet. Young also asked how bypassed sand was being treated in the analyses. Sidecast dredging is not in the tables because it is just moving sand around within the inlet system. What percentage of the dredged material is being placed on the beach. Tschirky noted that post construction is what a fairly high percentage versus a low percentage prior to groin construction. How can there be a 50% deficit of dredged material not making it to the beach when almost all of the dredged material was being placed on the beach? Jeff Sheldon commented about converting shoreline change to volume change and that was subtracted out to show that if no nourishment or nearshore disposal occurred than this would be the worst-case scenario for that beach. Young felt that Beaufort and Oregon inlets could be treated the same in the analyses. Sheldon explained. You start with shoreline changes rates and then convert to a volumetric change based on a profile. Now we can show a volume change over a certain interval. Then, every cubic yard that was placed along the shoreline from dredging (including on the beach and nearshore) to show a worst-case scenario where no material was ever placed there then this is how the shoreline might have changed. Then, different scenarios are presented in percentages where a percentage of that dredge placement material would have made it to the beach through natural shoreline / bypass processes. Jarrett wondered what the purpose of the percentage scenarios (0, 25, 50%). This was done to show that some of the sand likely did occur separate from the dredging activities that added sand volume to the beach. Because sediment transport and budgets are complicated, simple scenarios were presented. A 0% would reflect the worst performance of a groin and 100% would reflect the best-case scenario. Sheldon noted that this was done to account for natural bypassing that would have occurred anyway (the dredging and dredge disposal was merely accelerating this process). Rogers asked if everyone could agree that natural bypassing at Beaufort Inlet is 0%? Sheldon disagreed. Zero may be what is happening there now but what would have occurred if no dredging took place? One of Young's issues is that some of the shoreline (and, therefore, volumetric) change was indeed due to the dredging. Sheldon noted that if people wanted to consider if a groin would block all of the sand bypass, then you should use the 0% numbers in the table. Overton suggested a paragraph to define this analysis better. Rogers also suggested adding a 100% value to be included in the table and the analyses.

Peterson also thought a policy statement might be appropriate if the installation of a groin structure has occurred and that dredging has had to occur because of that structure then the second issue (inlet/coastal engineering in response of groin construction) occurred because of the first (groin construction). Jarrett would also like to see the dredging numbers used to “net out” volumes included in the appendix (and referenced in the report). Overton was hoping that the dredging/nourishment numbers used in this report would be the same numbers used by others (i.e., would these numbers be provided by the USACE)? Overton also asked if any losses could be calculated from the numbers (i.e., many times dredged volumes are not the same as placed volumes). Overton was also curious as to why all of the numbers were converted to rates (dredging is many times episodic and not cyclic). The number is understood (as a rate) but may need to be clarified in the report. Riggs also noted that it would be helpful if aerial photos used, then the dates could be documented so that it could be easy to see if these photos (shoreline interpretations) were associated with following storm events (and would the data be biased because it was just after a storm rather than a background dataset). Overton felt that more explanatory paragraphs could be provided for readers that do subsequent analysis using the data and methods in the report (e.g., is an assumption made that sediment placed in the nearshore makes it onto the beach?).

Birkemeier commented about the Oregon Inlet terminal groin. Overall, it was not easily clear that the areas immediately south of the inlet were “stable” because of the ongoing mechanical dredging bypass but the shoreline migration south of that area (beyond the three-mile analysis window), the shoreline erosion continued at a rate similar to that prior to installation of the groin. There was also some confusion on the time period (1984-88 then starting again at 1997 – what happened to the time between 1988 and 97?). M&N was trying to grab shorelines ahead of groin construction and then afterward (and, in this case, the groin was being constructed between 1988 and 97). Overton asked the report to reflect these decisions – if a certain rate or dataset or range was used, just put in a paragraph to explain why.

Young was commenting on page 218 that discussed nourishment placement at the inlet. M&N did acknowledge a typo there (also in another table) – the 708 and 452 should be 461 and 314, respectively. Also, the dredging numbers are based solely on material from the inlet system (additional volume came from the “back” channels). This was done to address natural versus mechanical bypass. This should be explained better in either the tables and/or the text. You’ll also see this at Fort Macon because some of the nourishment material came from Brandt Island versus the inlet system. Where the USACE gave them spatial dredge placement data at inlets (i.e., stationing data), then the volume was distributed evenly (for calculations) between those stations.

Benton noted that the charge was to identify what the impacts of a terminal groin might be on the inlet system. In section two, a detailed sediment budget beyond the scope of this project is noted. The problem is that the details necessary to answer the question being posed here about terminal groin impact (or potential impact) are not addressed (or can’t be without these data). That’s not M&N’s fault, it’s just the circumstantial – not

enough time and money to do this. Of the data that have been put together, it is questionable based on data quality, time frame, and spatial distribution. Benton feels the report and its conclusions are vulnerable. Overton stated that the data are the data. Benton was not sure the data could be used to address the charge of the study. Peterson wondered if the zero lines were better than if the Panel used radial transect line. Overton noted that once a groin is emplaced and the fillet it filled, then you have a fixed zero point and a fairly straight shoreline. Johnny Martin noted that M&N looked at the five study areas and didn't feel any error was put in the analysis by not using radial transects that wrapped around the throat of the inlet. Benton cautioned against using any shoreline dataset where one shoreline is parallel to your baseline and one was not. Peterson felt this was another area where the methodological choices could be addressed in the text. Birkemeier noted two impacts of the terminal groin – one is that they affect inlet movement and the other is their effect on the downdrift shorelines. Overton wondered if the groin could become the “zero” transect/baseline for earlier analysis. Maybe the radial transects are more useful on the other (non-construction) side of the inlet. Jarrett wondered if so much time had to be spent quantifying this when the qualitative question could merely be asked that, after construction of a terminal groin, does the adjacent beach remain in place?

Cleary noted that so much time was being spent on Oregon and Beaufort where dredging absolutely influenced the system. At Beaufort, dredging influences the ebb delta which, in turn, influences the shoreline change. It's difficult to sort out the influence of dredging and the feedback from delta morphology changes. Riggs noted that here are two inlets that have been modified – it started out slowly but the more you get into it than the more involvement (engineering wise) that is required. This is demonstrated in these two inlets (i.e., you are now committed to the management program after the groins are in place). Jarrett commented that is why he suggested in not attempting to subtract out beach fill from the shoreline analysis. It's clear why it is being done, but it may not be useful. What are the sediment pathways around natural inlets and, after a groin, address how those pathways are disrupted. However, a lot of time has been spent here discussing details that may not be necessary for final conclusions. Benton wanted to get through the remaining questions before these final conclusions were discussed. Jarrett didn't like how volume was calculated as a surrogate for shoreline change.

Peterson noted that one of the huge flaws in this report is that the uncertainties of the data, analysis, and eventual conclusions were not addressed in the report. Cleary suggested spending more time to discuss the additional inlets (other than Oregon and Beaufort – both of which are totally modified systems). Young thought that Amelia Island might be the best inlet dataset but the groin has only been there for a couple of years. Benton suggested it would be important for this study to consider what type of study should be undertaken to address the terminal groin questions. The important question here is the cumulative impact of all of these activities since the Civil War. Rogers agreed with Young that the only Florida inlet that could be analyzed without a suite of other influences was Amelia Island. For example, at John's Pass, the nearby groin field also influences the shoreline as well as a collapse of the ebb shoal complex. Overton noted generally that when you use any shoreline data you need to understand

what was going on in the system at the time the data were gathered. Benton thought that the question also had to be asked, “What do you have to do in conjunction with a terminal groin.” There is no such thing as just a terminal groin – dredging, beach fill. Birkemeier asked again, simply stated, “What is the impact of a terminal groin?” Some of the actions following a terminal groin project aren’t necessarily connected although the system itself is very connected. Peterson noted that if the term “immediately” was used (relative to aerial photos taken immediately after a storm event), then immediately (days, weeks, months, etc.) needed to be defined. Young wondered if this discussion was the formation of a consensus on what the outcome of this study might be after noting the complexity. What does the Panel do with this consensus of concern? Overton was hoping that these comments would be addressed by M&N so the Panel could, after these comments were addressed, could actually draw conclusions from this study? Birkemeier asked M&N if they felt they had enough data (and the right data) to make statements and draw conclusions about what the data show? Tschirky felt enough data were there to comment on what the data show, but the policy question was not part of the scope of the study. Sheldon said there would be a summary of findings for other people to draw policy conclusions.

Peterson felt that M&N was doing a good job getting the data that existed. Peterson also understood that M&N couldn’t answer the policy question(s) and the Panel shouldn’t be either. However, there was a step between these two end members related to the analysis of the data and the conclusions that could be drawn. Peterson felt that uncertainty really was the major message from this study. Young commented on some of the draft conclusion statements that contained words such as “likely” and “appear.” Overton wondered if M&N tried to put an uncertainty band around these data or analyses, could they also address why the uncertainty existed (e.g., if there were more data on sediment budgets, could conclusions then be drawn or at least drawn with more certainty). Benton felt that if the existing data were not enough then the report needed to state that. M&N intended to present these data fairly. Overton wondered if moving forward that the datasets needed to further address the study’s charge could/would be identified.

Benton offered comments for material starting at the bottom of page 3-4. Overall, the geologic section made more sense than the first section. Benton would like to see more integration of the two chapters. This chapter was supposed to focus on the effect of groins on inlet/coastal processes. The chapter needs to discuss further the role of storms on coastal habitats. Cleary asked how you could address the effect of a 100-foot terminal groin on a 40-km long barrier island. Benton gave the example at Oregon Inlet. When the groin was put in place, it stopped the inlet migration, which in turn affects the barrier island evolution. Cleary commented that the other inlets chosen were not migrating inlets. Benton felt that the chapter should discuss the impact of stopping Oregon Inlet migration should be addressed (the report only states that the groin stopped the migration). Benton also noted that sea level rise could steepen the shoreline profile (noted in the chapter), however, that could also occur by dredging and beach fill along the shoreline. Benton also noted that Fitzgerald (in the M&N report) that the Oregon Inlet channel identified the authorized depth of the channel was 14 feet. Was this correct? Yes.

Overton adjourned the meeting at 12:08. The meeting resumed at 1:12. Overton asked if there would be some summary comments on the first part of the meeting or whether the Panel should move on to discuss the environmental portion of the study. Overton reviewed the timeline to address Birkemeier's question. On February 15<sup>th</sup>, the CRC/CRAC subcommittee will meet. Rogers asked if there would be a different product for that meeting. Johnny Martin thought that might be difficult at this point. He viewed this as receiving Panel comments and CRC/CRAC comments and then incorporating them. On February 17<sup>th</sup>, M&N is on the CRC agenda to address the study. The steering committee (CRC/CRAC) will be reporting out to the full CRC and CRAC at that meeting. Overton mentioned that March 1 will be the final report from M&N but not necessarily the final report as approved and amended by the CRC/CRAC steering committee. Overton reminded the Panel that individual members can continue to make comments after this meeting. Comments will be sent to Jim Gregson and the Panel will have until the 15<sup>th</sup> to provide input. These will not be in the sense of pure peer editing (i.e., not necessarily incorporated into this draft version of the report or even addressed at all). Overton thought it would be appropriate to copy all Panel members on the input provided to M&N via Jim Gregson. The deadline will be 9 am on February 15<sup>th</sup> noting the tight timeline to finish the project by March 1 (at least the M&N portion of the project).

Overton asked again if there should be a summary on the morning's discussion of chapters 2 and 3. Riggs commented that the State of North Carolina determined that the six-mile area around Oregon Inlet would be the impact area, then he strongly recommends that the actual data used are clearly defined in the report (how much data, the temporal and spatial extent, and why those data were or were not used). Don't come to the conclusion that a one-mile dataset (i.e., the groin fillet) was the only area of impact (especially areas farther down the shoreline outside of the study area). Overton reminded M&N it was important to note where the data were and why they were used – clearly document the data, analysis, and analytical techniques used in the report. Young found the geology chapter (chapter three) to be generally problematic and duplicative. Duncan Fitzgerald (chapter author, M&N subcontractor) presents three different erosion rate datasets (Overton's work, Riggs' data, and a talk/lecture by Cleary) for Oregon Inlet. All of these data are different than the data used by M&N in chapter two. None of these datasets were used in original analysis but rather just mentioned in the report that these data exist. It's completely different than M&N's approach. The same issue exists for Beaufort Inlet (i.e., Duncan Fitzgerald cites a talk given by Cleary). Overton mentioned that having different sets of shorelines, while it doesn't matter what framework is used (engineering versus geological), it must be clearly stated what was used and why. Young mentioned that a shoreline is a snapshot in time and there could be numerous factors on what influences shoreline change (storms, dredging, etc.). Birkemeier noted it would be a lot of work but you could put the geologic framework for each inlet site analyzed to be more consistent.

Overton stated that this was the physical setting description regardless if it is in an engineering or a geological framework. Cleary felt that you couldn't expect a

subcontractor to do that because it wasn't in the initial charge. Jarrett felt a given could be that the shorelines did X and that the geologic framework addressed, in part, why the shorelines did X. Peterson felt it shouldn't just be the inlet, it should also include the environmental and habitat issues at the inlet. Dawn York (M&N subcontractor) presented the M&N environmental data. Dial Cordy, for M&N, collected biological resource data, reviewed existing data and literature, evaluated available data and compared regionally, and is currently addressing Science Panel comments from the January 19<sup>th</sup> meeting. General results include: 1) biological resources continue to use locations where terminal groins exist, 2) anchoring the end of an island may curtail an inlet's natural migration pattern but also restore degraded habitats, and 3) minimizing natural overwash at the end of an island might also impact habitat. Also, fillet material should be compatible with adjacent beaches, terminal groins can reduce number of beach placements to address erosional hotspots, and proper designs and dredge placements can minimize littoral transport effects and minimize resource use effects. With that, York turned it over for comments and questions.

Peterson asked if those results just presented were in the report. York noted there were some summary sections included (specifically page 4-116). Young was wondering about the conclusion of minimizing the number of beach placements of fill material. Layton Bedsole said this comment came from an individual interview with somebody (either from FL DEP or USACE). Peterson wondered if this was hearsay versus true data. Young felt that wasn't a true data-driven conclusion. Maybe Dial Cordy (DC) should not be drawing this conclusion, maybe it is up to M&N to draw this conclusion from DC's data? Overton noted it should be consistent with the beach fill data presented in the report (chapter two). Birkemeier thought this might be a more general conclusion and there might need to be a more general conclusion section of the report. Peterson noted that the biological conclusions came from the knowledge of the physical processes of the inlet and how those processes are influenced by terminal groin construction. If you take something like a plover, they need an area free of vegetation for nesting but the babies need a suitable habitat to find prey for foraging. Other species forage on the backside of a barrier. Biological resources might be impacted if they need areas that are dynamic rather than stabilized (by a groin). Rogers noted that overwash can go on anywhere on the island so it was rather the oscillation of a barrier spit at the inlet (that affects these habitats). Peterson agreed, although it is critical to couple the biological response to the physical impacts to the island. Peterson wondered if you put in a terminal groin, do you have to nourish more or less? That's the kind of information that needs to be provided so the impact of a terminal groin can be assessed. Cleary argues that dredging of a shipping channel can also influence this (through the increased channelization and subsequent changes of tidal prism and delta configuration). Jarrett stated that there is not a scheduled maintenance event of the beach associated with the Ft. Macon terminal groin. The nourishment there is to keep the channel navigable – it has nothing to do with what is going on with the beach. Overton commented that an increasing need for beach fill could be independent of terminal groin construction (houses in harm's way might have driven beach fill without a groin). Young thought that it would be nice to see a graph with time on one axis and nourishment on the other axis and also show what year the groin went in. Certainly, it is complicated but at least you could put the nourishment and groin

construction in perspective. This would be an interesting exercise at the study sites. If nourishment is increasing with time, then you search for the reason why that nourishment is increasing. Jarrett stated that Ft. Macon / Beaufort Inlet was not a good place to determine this because the sand going on the beach was not associated with whether the groin was there or not. Peterson wondered that if you challenge this question with the available data, how can you ask the other questions with the available data. Rogers had to admit that in these near-inlet places without groins, nourishment on its own does not work (e.g., Shallotte Inlet at Ocean Isle Beach east end). In this case, the beach fill option does not work without the terminal groin structure. Young felt this was simple question to ask (i.e., nourishment versus time). Young acknowledged that all the data were there in tables but a lot of the tables could be moved to the appendix and some graphs showing some of these data would be more useful than just the tables themselves. Birkemeier wondered if elevation data (of the groin) would be helpful.

Jarrett also wondered what the impact of removing 1.5 million cubic yards from the Beaufort Inlet system would be without the terminal groin (and potentially placement of this dredged material on the beach?). Peterson also commented that there seems to be more known on the sea beach amaranth than was included in the report (regarding habitat). York stated that DC noted a qualitative analysis showed there was no connection between sea beach amaranth populations and nourishment. Riggs asked about the last Panel meeting on this report where he remembered a limiting factor of the project was not addressing the changes in the primary habitat (i.e., the barrier island system) that comes with not just the terminal groin. He posed the question if a description of the basic change in the barrier (which was not the same today as it was 50 years ago) system was addressed. Bedsole commented that he noted Riggs' comment and DC was addressing this comment as best as they could. Riggs wanted people to understand that society was having to deal with overall changes in the barrier island due to development. The change in habitat is because of, in part, development and coastal management policies in place and occurring over the past few decades. Peterson felt this was the more generic understanding of the habitat and barrier system that should be addressed (not inlet specific). Restated again, Peterson didn't care about specific sites, he was concerned about the generic field of sedimentary geology and the related coastal dynamics and how changes to those dynamics (i.e., terminal groins) affects habitats. Peterson also had concerns about the ability to do thorough before and after (groin construction) analyses of habitat(s). Was there an obvious relationship or are the data even adequate enough to address that conclusion (probably not adequate – conclusion appear to go beyond what the data allow). York noted that DC was able to collect data prior to construction of groins but other datasets were based on what resource agencies required (i.e., some agencies specifically wanted sea turtle nesting and habitat data but might not have exact nesting points such as at John's Pass Inlet). Peterson felt getting a feel for whether or not these data are adequate to analyze is an important component in this study. Casey Loft did some work in FL suggested that plovers are not as successful in areas that received nourishment. York noted that DC had the abstract to which Peterson was referring. Peterson felt that generally the environmental portion of the study had a lot of irrelevant data (the section is bloated).

Overton asked Chris Dumas to come up and discuss the economic section of the M&N report. The method/approach identified properties and infrastructure at risk (proposed Panel IHA risk lines); assemble current property and infrastructure location and value data; add up economic value; include property loss, public infrastructure, and tax base losses; and include discussions and diminished market value, impact on second row buildings, as well as environmental and recreational values. Dumas noted he did not get a description on how the Panel risk lines were drawn but only maps. Overton noted it might be important to have included a description on how the Panel's inlet hazard risk lines were drawn. Dumas noted that some counties had assessed property values on their GIS websites and some did not (but those data were still acquired from the counties). Most assessments are relatively recent. Sewers, roads, and water line infrastructure was included in the analysis. Mostly residential property parcels were associated with inlets but some commercial properties did exist (some were also public properties such as Ft. Macon State Park). Other studies were considered as far as transferring property value to a second row property if the first row was lost due to coastal processes. There probably is a net positive effect – positive value from second row becoming front row but negative loss based on the threat of erosion that made second row front row. Overton asked if these studies of value transfer and model development were based on oceanfront or inlets. Dumas noted that the pre-existing analysis considered used both inlet and oceanfront. The M&N study did not adjust their models based on these studies but offered them as a sidebar discussion.

Benton was concerned that the 30-year risk lines in the inlets did not mean that the entire areas was at the same level of risk nor was there the same level of risk through time (shoreline can be lost and then accreted around an inlet whereas the oceanfront shoreline does not oscillate in the same capacity). Benton asked if the land value was addressed separate from the structures. Rogers and Dumas noted those data are included in the draft M&N TG report. Dumas noted that a lot of probabilistic analyses were not available for inlet areas so they were not used. The uncertainty analysis is important, but the data were not available to analyze the uncertainty at this point. Peterson thought Dumas did a good job but was concerned that the economic data might be misleading. If the values are all added up in this 30-year risk zone, the issue might be that a similar zone should have been used thirty years ago to ground-truth the current situation to see how this analysis would have ended up in a real world situation (i.e., how would the same modeling efforts thirty years ago compare to on-the-ground results today). How accurate would the models have been? Peterson was also concerned that also not putting sea level rise and potentially more frequent and higher amplitude storms into the analysis. Dumas did discuss the presence or absence of terminal groins and how that impacted value. To answer that, other assumptions must also be considered (including sea level rise, etc.). The last meeting of the Panel addressed some of these uncertainties but there was the feeling that so much uncertainty exists with these variables and assumptions that they were not addressed in these analyses. Dumas noted that many of the data existed (as far as historical analysis and what has happened during the past 30 years), but there was not enough time to gather and analyze the data for this study. In addition, you might have historical information, but it is not as straightforward over just getting those data. Overton wondered if the existence of the 30-yr risk lines from the Panel influenced the

study at all or are they irrelevant? Young noted that what Dumas did was fine but a list of the caveats was necessary.

Cleary noted that twelve inlets are listed (page 6-1) although only one shoulder of some of those inlets are candidates for terminal groins. Why was the whole island included? Johnny Martin referred to the legislation and Tschirky noted that the General Assembly did not ask for a list of potential sites for terminal groins to be installed or considered. Dumas didn't want to bias interpretation by selecting inlets up front. Overton stated that M&N was merely adding up value. However, summing those data as if every single site was a candidate for a terminal groin might be the issue. Rogers asked if the Panel could suggest the number of sites that could be considered for TGs. Since nobody disagrees with Cleary but nobody has a number or exact locations, all they can do is look at all of the inlets. Dumas is just providing economic evaluation on both sides of the inlets (one side could erode but the other could accrete). Gregson noted that the portion of legislations addressing NC inlets only talked about the economic value exposed to shifting inlets, it did not address the impact of terminal groins (or the lack thereof). Dumas noted he tried to identify properties at higher inlet risk by looking at properties oceanward of the proposed inlet hazard area 30-yr risk lines (rather than using all properties within the proposed IHA boxes).

Rogers presented a qualifier important to the study. The numbers from Bald Head Island were about 20-25% of the values for the whole state (and the line being used is highly irregular and is an overestimate because the line hasn't been cleaned up yet so put an asterisk on BHI that the Panel understands the 30-yr risk line is not complete). Overton felt there was a gap in knowledge by the parties using it versus the party (the Panel) that developed the risk line. Overton wanted the understanding of how the lines were drawn to be included in the report (and how those methods might be used in an economic analysis assumption or set of assumptions). Rogers also felt the Panel could come up with a way to qualify the risk lines that they were not necessary developed to be associated with groin protection. Rogers wondered if the Panel could come up with a list of inlets (or sides of inlets) that were not candidates for groins. Jarrett noted that these risk lines were not necessarily where the shoreline would be in 30 years but, rather, an area at risk to inlet processes over a 30-yr period. Tschirky noted that the report should be expanded to note that the 30-yr risk line zones were not necessarily zones that would be protected by a terminal groin (nor would they necessarily be at risk to complete destruction without a terminal groin). Rogers asked if the Panel should note which inlets or shoreline areas are not candidates for terminal groins. Rogers didn't want people to come away from the report that the Panel supported all inlets for terminal groin locations. Overton went back to her statement that the M&N report should address that the 30-yr IHA risk lines were not meant to be hard 30-yr periods nor were they intended to be areas that could/would be protected by TGs. Jarrett also added that the entire 30-yr risk area would be protected by a terminal structure (i.e., some areas would still be at greater risk).

Overton there were five minutes left but three sections had not yet been discussed. Peterson commented that scenarios (economic?) could include net erosion on one side and net accretion on the other to balance the positive and negative effects. Also, you

could look at public valuations that could be netted out (such as federal flood insurance, FEMA storm response) – there's a public subsidy that may be over-inflating the value. Further, the valuations in general may be higher because the assessments were made during a booming real estate market. Overton asked the Panel who was willing to stay after 3:00 pm. Overton would re-visit the question at 3:15. In the interim, Johnny Martin reviewed the construction techniques section. Martin asked the Panel to look at the graphs starting on page 5-15 because M&N tried to get to some of the shoreline issues related to groin length. Birkemeier was concerned that there were only five data points in the study (five inlets) and it is tough to draw conclusions from five data points. Amelia Island also seemed to violate the general conclusions made in the draft report. Figure 5-13 seems to show, after netting out nourishment, it appeared that 100-120k yards seemed to be necessary for beach fill. Young wanted that broken down into smaller increments so longer shoreline stretches were not aggregated together. Maybe quarter mile increments? Would that show meaningful trends? Birkemeier also agreed that the measurement intervals used in the current report were arbitrary. Martin asked the Panel to look at the graphs in this section and provide comments. Birkemeier also commented that Oregon Inlet and Amelia Island were so completely different that they may not provide a meaningful comparison. Martin noted he could explain why they were included a little better.

Peterson asked about adaptive responses. A lot of projects start with one design, find it's not working, and then is modified. Should there at least be some discussion of that in the report? Martin noted that was included only for material types in the construction process, but it could be strengthened in the report. Rogers wanted to see clearer language on the ease and effectiveness of removal should something go wrong. It is not clear in the legislative requirement but it should be included. Young wondered if a cost estimate or case study could be provided? Rogers suggested that steel sheet piles seem to come out easiest so that may need to be considered in potential TG design in NC.

Martin moved on to cost estimates (construction and maintenance). Some materials are not appropriate for structures in deeper waters. Also, maintenance costs, initial beach nourishment, as well as permitting, design, monitoring, and removal costs. Rogers thought that some of the numbers looked high except for removal (might be low) but he didn't have better numbers. Riggs asked about ongoing beach nourishment. Jarrett also thought the annual costs were high (relative to the NC TGs). Martin agreed noting that the costs are higher for the FL projects. Rogers was fine with a high number. Martin finished up by reviewing the potential TG locations (e.g., navigable and dredged inlets). Young wanted the "Terminal Groin" heading to be removed from the last section because that many of the structures in the table were not considered, at least by the Panel, as terminal groins.

Overton adjourned the meeting at 3:15.